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## Nature: A Rich Source of Potent Therapeutics

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## Summary

Nature is a rich source of candidate medicinal products. Herbs, plants and microbes have been shown to deliver potential therapeutic remedies for inflammatory disease, complex infections, metabolic indications and neurological disease.

Three herbs *Sambucus nigra*, *Centella asiatica* and *Echinacea purpurea* are showing tremendous potential in the treatment of inflammatory and metabolic diseases. The herbs have been shown to elicit promising anti-inflammatory effects in both oral disease as well as diabetes. *Sambucus* and *Echinacea* inhibit proinflammatory activities and have demonstrated anti-bacterial activity. *Centella* increases collagen production and contributes to wound healing. The herbs have been delivered in a variety of formats including oral rinses, transmucosal patches and hydrogels. Positive clinical results have been reported for gingivitis and periodontitis [1] and in the treatment of diabetic foot ulcers [2].

One of the major medical challenges today is combating biofilms that are frequently found on implantable medical devices. Biofilms are complex structures that include diverse microbiota, some of which can be pathogens. The microbes in biofilms are encapsulated within a polysaccharide matrix. Antibiotics for the most part have not been successful in controlling biofilms. Recently, anti-microbial approaches based on "microbial exchange" have shown much promise. Probiotics that have been used to treat gastrointestinal disorders may have significantly broader healthcare applications. Reports have demonstrated the potential for probiotics in oral health [3], cancer and cardiovascular disease [4]. Cannabis has been used by many societies and cultures over time providing both recreational as well medicinal properties. Three subspecies of cannabis have been characterized including *cannabis sativa*, *cannabis indica*, and *cannabis ruderalis*. The phytochemical components of cannabis are numerous, and include more than 400 naturally occurring compounds and greater than 100 different cannabinoids [5]. The five main cannabinoids including cannabidiol, cannabichromene, cannabigerol,  $\Delta$  9-tetrahydrocannabinol and cannabinol demonstrate strong antimicrobial activity [6].

Intensive biomedical research has focused on identifying potential applications of cannabinoids. The development of a specialized medical cannabis has resulted in a cannabis rich in Cannabidiol (CBD) and low in  $\Delta$  9-tetrahydrocannabinol (THC). Clinical application areas being pursued include seizures, anti-convulsive therapy, chronic pain, spasticity associated with multiple sclerosis, post-traumatic stress disorder treatment, memory loss-Alzheimer's disease and cancer tumor growth [7]. With the innovative advances in molecular biology and genomics, therapeutic applications of defined compounds isolated from cannabis are now in reach.

Identification of new chemical entities may have slowed down, but natural resources are giving rise to diverse compounds that are poised to make a significant impact on the health and quality of life of many people.

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